University of Michigan

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NOTES.

There are eighty-four miles of solid walks laid out inside the Centennial buildings.

Boston architects' offices are rather quiet this spring, though certain firms have more work than usual.

Mr. A. B. Carpenter has been elected City Surveyor of Chippewa Falls, Wis., by the Council, at a salary of $5 per day.

The City Council of Fort Wayne, Ind., has suspended proceedings in the Waterworks question until the source of supply is determined upon.

The iron stand-pipe of the Bloomington, Illinois, waterworks, just completed, is 225 feet high, 8 feet in diameter, and holds nearly 100,000 gallons.

Engineer McAlpine's plan for the New Worcester Waterworks reservoir at Lynde Brook has been submitted by the authorities to the county commissioners for approval.

In Germany the telegraph wires are in future to be carried underground instead of being supported by posts. The object of this change is to prevent the interruption of communications which regularly follows upon a great storm.

A stone passed through Indianapolis, from the Greensburg quarries to the Centennial, which was 20 feet 8 inches long, 10 feet 4 inches wide, and 6 feet thick, containing 213½ superficial feet. This is undoubtedly the largest flagstone ever shipped in the State.

The Dutch Government will show at the Centennial Exhibition a collection of models, illustrating the progress made by Holland in engineering, and consisting of groups of models of the principal great reclamation and other works undertaken by the State. Among them will be shown the Haarlem drainage, the Dordrecht steel bridge, the Kuilenburg railway, a new steam pump, models of sluices, relief map of the Zuyder Zee, etc.

State Engineer and Surveyor Van Buren, and Lieut. Willard, of the United States engineering corps, held frequent consultations last week, and concluded upon a general plan for improving the navigation of the river, as contemplated by the law appropriating $40,000 for the work. As soon as the present freshet subsides surveys will be made, commencing at the "Overslaugh," a few miles below this city, and dredging machines put to work at once.—*Albany Evening Journal.*

The bill to authorize a survey of the state of New York has passed the Legislature. It appoints a commission of seven of the most competent men for the purpose, who are to serve without pay for one year, and appropriates twenty thousand dollars to defray the expenses of the survey during the present year. This decription of survey will have cost when completed about $250,000, and is copied from that adopted by the Swiss, the most practical as well as the best educated nation of Europe, where it has given perfect satisfaction to the taxpayers, the law courts, the scientific men and the property holders.

The settlers of La Plata Co., Colorado, are of the opinion that there is something very suspicious about the last summer's survey of the Ute reservation in their vicinity, and the question is asked where the money came from to pay for the survey, the reported amount being $25,000, as no appropriation was made for it. They moreover would like to know how the survey could be made without any of the surveying party being seen by Indians or settlers, and the only solution of the mystery which is offered, is that perhaps it was one of the surveys in which John Delano was interested.

Electric Railway Signalling, without the Use of Wires.

Abstract of a paper by Prof. William Robinson, read before the Society of Arts, Massachusetts Institute of Technology.

To those who are familiar only with the intricate and expensive system of line wires, the question naturally arises, what else can be successfully used to conduct the electric current in railway signalling? Excellent conductors are found in the ordinary rails of the track, resting on the ties in the usual manner and without insulation, an idea at variance with the generally received opinion that the electric current will be speedily lost by passing to the earth, especially in wet weather, unless perfect insulation is secured.

The idea of using the rails as conductors for electric signalling purposes seems to have been first suggested in an English patent of 1848. This was merely a suggestion, and no attempt was made to prescribe any specific method for the purpose.

In 1853 an English patent was granted to George Dugmore and George Millward, in which is described a method proposed for using the rails as conductors. The design of the invention is to communicate between trains on the same line, and between trains and stations, for which purpose it is proposed to use long sections of rails. The unpractical part of this system is that, to make it operate, it is necessary, as the inventors say, to insulate the opposite wheels of all the carriages from each other, in order that electrical connections may *not* be established between the opposite rail lines by the wheels and axles. It is not at all probable that any company will ever run a train fulfilling this condition.

In William Ball's English patent of 1860, the rail sections used are short, "twenty feet, more or less," and are the terminals of line wires which connect with the battery and magnet at the station. The signal at the station is visual, and consists of an indicator operated by wheel-work controlled by the electro-magnet. It is essentially a "wire system," using line wires for the main circuit, and open to the objections of all such systems, viz., of not indicating danger when a train breaks up or enters from a siding, and of showing false signals when the circuits or signal mechanism or battery are deranged from any cause.

Of the systems in which the main circuit consists of long sections of rails, the first patent in the United States was that of F. L. Pope, in 1872, which is apparently the same as that of Barnes and Hancock in England, in 1868.

The first part of the invention consists in connecting the two poles of a battery with the two rails, the junction of the two being only completed at the time the wheels of a carriage, united by their axles, pass over two rails; so that at all times, except when a carriage is on that line of rails, the circuit will not be complete, but so long as a carriage remains on them the battery will work. Between one wire uniting one rail and the battery is placed a magnet, which acts against a lever, (of course when the circuit is complete) and the lever is connected with a rod leading to the signal on a post. As soon as the wheels of an engine, truck or carriage place the battery into action by completing the circuit, the magnet attracts the lever, which throws the signal to danger. So long as the carriage remains on the line the circuit will be maintained; but so soon as the circuit is broken the battery will cease to act, and a weighted lever throws the signal to clear or caution, as desired.

The objection to the system is that, the circuit being left open between long sections of rails, the ties and earth complete the circuit in wet weather, whereby the magnet is continuously magnetized without the presence of the train. That this is fact, and not theory, has been demonstrated by the experiments of Mr. Robinson. In the system of Mr. Robinson a new principle is involved. The rail sections may be one or several miles in length. At one end of the section the battery is placed, one pole attached to either rail, while at the opposite end is placed the magnet, one electrode attached to either rail. Thus a constant metallic current is established through the rails and magnet. The principle of operation is this:

When several courses are presented, electricity will follow that course which offers least resistance to its passage; the rails being metal, of very large cross-section and consequent great conductivity, are greatly superior as conductors to any surrounding media, hence the electricity adheres to the rails and keeps the magnet magnetized, even during the heaviest rain, in preference to passing off to earth. The magnet keeps the signal concealed; when, however, a train enters upon the section from either end or from a siding, the wheels and axles instantly short-circuit the current, because they are better conductors than the small wire of the magnet. The magnet being thus demagnetized, releases its armature, and the signal is mechanically thrown to "danger," where it remains while the train or a car is on the section. On double-track roads no line wires whatever are used.

This system is claimed to be superior to any other in the following respects: A signal can be successfully operated through a long section of rails; it will show the presence of a portion of the train on the signal section when a part of the train, having broken loose, has passed beyond the section;—breaking of trains is, perhaps, the most fruitful source of collision;—it will show the danger signal when a train has entered within a section from a side-track or from the opposite end from that usually entered upon; a broken or torn up rail will show the danger signal; any tampering with or derangement of the mechanism or battery will show the danger signal, so that an error from any cause will be in favor of safety It is impossible to show "safety" when the danger exists which the signal is designed to avert. The instruments are never adjusted except the first time, and the battery runs a hundred days without renewing.

There is a modification of Robinson's constant circuit in a patent granted to F. L. Pope, Oct. 7, 1873. In this, the magnet and battery, at one end of the section, are connected together, and the terminals connected to the opposite rails of the section; while at the other end precisely the same arrangement is made. Similar poles of the batteries are connected to the same rails, whereby the batteries are opposed to and neutralize each other, keeping the magnets demagnetized, until a train, entering upon the section, short-circuits and thus vitalizes the batteries and magnetizes the magnet. This is a very complicated system and possesses no advantages over the simpler one by Mr. Robinson, to whom the principle of the constant circuit belongs.

His conclusions were as follows:—

There can be no perfect system of automatic signalling which does not involve long sections of rails as principal conductors. It is impossible to use long sections of rails for the purpose, on the principle of opening and closing circuit, as the uniform and repeated failures of twenty years have proven. The only known principle on which long sections of rails can be successfull used is that actually involving a constant circuit, by which is understood "a circuit whose magnets are operated or controlled without actually opening the circuit through said magnet.

(TO BE CONTINUED.)

Analysis of James B. Eads' New Arch.

BY D. W. BOWMAN, C. E., SOUTH PASS JETTY WORKS.

(Written for Engineering News.)

(CONCLUDED.)

As the line of strains for a uniform load is a parabola, it is easy to see that if one entire half of the bridge were loaded there would be two semi-parabolas in this loaded half, one an arch, the other a suspension, which would divide the load between them. The horizontal component of the tension in the counter-arch at the center, must be equal to the horizontal thrust in the arch at that point, and the horizontal component of the thrust of the arch at the end, is equal to the horizontal tension of the counter-arch at the same point. Hence the arch and counter-arch when ½ the span is loaded, mutually sustain each other in the parabolic form, and are strained similar to the arch when the entire span is loaded.

The only strain on the interior bracing of the loaded half is tension in the verticals, arising from carrying part of the panel load to the arch, and from thrust at the crown caused by the inclination of the supporting strut or semi-arch. On the unloaded half the strains are similar but less, except that instead of tension the counter-arch is under compression. In other words, no strain on the diagonals of the bracing of either half, occurs when either half is fully loaded, but the verticals of both the unloaded and the loaded half are in tension.

The maximum compression in any diagonal occurs when the load is continuous from the nearest abutment to the end of diagonal nearest that abutment, including full panel load there, and maximum tension where load is continuous from center of bridge to end of diagonal nearest the center. In either case there may be *any* combination of load on the other half of the bridge. For any diagonal the tension and compression are numerically equal, and are symmetrical with reference to the center of each lenticular truss, being greatest there and diminishing rapidly towards each end.

The maximum tension, in the verticals of either half, occurs when the other half is entirely loaded and when the load also extends from the nearest abutment to the vertical in question, including the panel load under it. The maximum compression occurs when the load extends from the center of the span to the vertical in question, not including this panel load. It will be seen that the strains are greatest at the center of the semi-arch, diminishing rapidly towards its ends, but that they are not strictly symmetrical as in the case of the diagonals, being slightly less in the half adjacent to the center, and also that the compressive are less than the tensive strains. Again, this maximum compression, when the strains arising from live and dead load are combined, is *reduced* by a quantity equal to the panel weight of the structure below the arch, and the maximum tension is *increased* by an equal amount.

In order to make a theoretic comparison with the truss, the material in each can be represented by the products of the strains in the different parts by the lengths of the parts. It has been stated that with equal depths, the maximum length of compressive members in the arch will be but one half that in the truss. For a span of this length, for which the strains are given in the diagram, in the most economic depths for each system the ratio of depth of arch to depth of truss will probably be as great as 1.75 to 1. Let l = length of span; d = depth of truss; $d_1 = d \times 1.75$ — depth of arch; w = load per unit of length.

Then strain at center of truss equals $\frac{wl^2}{8d}$. Theoretically it dimishes to zero at the ends, and the strains vary as the ordinates to a parabola the length of whose base = l and whose height = $\frac{wl^2}{8d}$. The area of this parabola represents the upper chord of the truss = $\frac{2}{3}l \times \frac{wl^2}{8d}$ and multiplied by 2, it represents the material in both chords = $\frac{wl^3}{6d}$. This is less than in practice would be used, as the cross section at the ends is of considerable area. In the best proportioned trusses the amount of material required in the web-system fully equals the amount in the chords; hence we have entire material in the truss represented by $\frac{wl^3}{3d}$.

In the arch the strain at the crown and throughout the tie is $\frac{wl^2}{8d_1} = \frac{wl^2}{14d}$. Therefore the material in the tie = $l \times \frac{wl^2}{14d} = \frac{wl^3}{14d}$. The ratio of length of arch to $l = \frac{11}{10}$ nearly, and the ratio of strain in the ends of arch to strain at the crown = $\frac{125}{100}$. The material in the arch may consequently be represented by the area of a rectangle whose length = $\frac{11}{10}\,l$ and whose height = $\frac{wl^2}{14d}$ + ½ the area of a parabola of the same length whose height = $\frac{25}{100}$ of $\frac{wl^2}{14d}$. Hence arch = $\frac{11}{10}\,l \times \frac{wl^2}{14d} + \frac{1}{3} \times \frac{wl^2}{56d} \times \frac{11}{10}\,l = \frac{143}{1680} \times \frac{wl^3}{d}$ and counter-arch = ¼ of arch as has been shown before = $\frac{36}{1680} \times \frac{wl^3}{d}$. Hence arch, counter-arch and tie = 143 + 36 + 120 = $\frac{299}{1680} \times \frac{wl^3}{d}$.

To express the amount of material required for the interior bracing in the same manner would require too extended a solution for this paper. From a calculation of spans varying from 150 to 700 feet the amount of material required for this is found to be about equal to that in the counter-arch for the same load. As the panel load, however, which may be greater than the assumed uniform load, (as a locomotive at the head of a train) will strain this bracing more than calculated, to make the comparison unbiassed as regards the arch, place the weight of the bracing equal to 1¼ times that of the counter-arch = $\frac{45}{1080} \frac{wl^3}{d}$. For the vertical suspenders, and for the extra lateral bracing required for the arch and counter-arch, ¼ the material in the counter-arch will be, from the calculations above referred to, a full allowance.

To summarize, arch = 143; counter-arch = 36; tie = 120; bracing = 45; suspenders and extra bracing = 27; total = $\frac{371}{1680} \frac{wl^3}{d}$ for the arch as a bowstring against $\frac{wl^3}{3d} = \frac{560}{1680} \times \frac{wl^3}{d}$ for the rectangular truss for a span of 350 feet. When used as an arch proper the comparison will be still more favorable to the arch. The ratio will be greater as the span increases and less as it diminishes.

The above comparison shows the material for the bowstring arch including the tie, to be 33 per cent less than for the truss for a 350 feet span. For a 250 feet span the arch bowstrung by this system has a saving of 20 per cent, and for 200 feet 15 per cent, over the most economic form of parallel chord truss. These figures are based upon careful calculations of this system and of the parallel chord truss for the different spans, with the same assumptions of load and same strains allowed per square inch of metal for same conditions.

Allusion has frequently been made above to the use of this design as a bowstring girder. The old form of bowstring girder as heretofore constructed has had several serious defects which have drawn upon it the well deserved criticism of engineers. No one of these objections exists however in regard to this design. The small strains in the interior bracing near the ends, show that no great deflection can occur there under a moving load. In every part of this design the strains are clearly defined and are borne by a perfectly adapted system of bracing.

It is believed that enough has been given above to show that this design can compete successfully with the rectangular truss for medium length spans. That it is the best method of bracing the suspension, either in one or the other of the forms shown in the diagrams or in a modification of these, must be admitted from a study of the action of the parts and of the diagram of strains given. It does more than any previous system has yet done; it entirely overcomes the strains caused by changing temperature, and by a system which acts at all times harmoniously, resists the distortion from moving load. But as rendering possible the economic construction of long span arches in place of suspension spans, it is believed that this invention will produce a revolution in bridge construction so soon as its merits shall be known to engineers. The existing prejudice against the use of the arch however, arising from the characteristics of the ribbed arch, will undoubtedly prevent as early and as careful an examination of it as it deserves.

With a system applicable alike to suspension and to arch construction, it is no difficult task to show the far greater economy of the latter. Indeed, when the heretofore vexing, uncertain, and unharmonious action of it under the varying conditions of temperature is avoided, it requires almost identically the same material as the suspension between the towers, avoiding the most expensive part of the latter as well as the anchorages and the shore spans, which together are nearly equal to the main suspended span. In cases where the approach requires no artificial viaduct, the entire cost of the latter is saved.

The following tables show estimates of the weight of a 350 span of 70 feet rise, calculated for a moving load of 2000 lbs. and dead load of 1500 lbs. per foot. The diagonals are calculated for moving load of 4000 lbs. and the verticals for 2500 lbs. per foot. The strains allowed per square inch of metal are as follows:

For tension, in tie 10,000 lbs.; in suspension 8,000 lbs.

For compression, in arch 9,000 lbs. (length = 17 diameters.)

For tension and compression, counter-arch 6,000 lbs.; diagonal 5,000 lbs.; verticals 8,000 lbs.

A greater strain per square inch is allowed in the verticals than in the diagonals, since in them the compressive strain is small compared with the tension. The suspending rods are each figured to sustain a 35 ton engine besides weight of roadway. Ten per cent is allowed for joints and connections,

Diagram of Strains.

FIG. 3.

Strains from live load of 2000 lbs. per foot. Span 350 feet. Rise 70 feet. Panel length 17.5 feet. Strains from live load of 2000 lbs. per ft.; +dead load of 1500 lbs per ft.

NOTE:—1st, Strains are in tons of 2000 lbs.; 2d, C denotes compression; 3d, T denotes tension; 4th, C+T denotes tension and compression.

ARCH.

Number of Piece.		Strain in Tons	Area in Sq. Inch's	W'ght pr. ft.—lbs.	L'ngth of piece—ft	Weight of piece—lbs
End	1	480.8	106.85	331.23	21.98	7280.4
	2	462.2	102.70	318.37	21.15	6733.5
	3	446.4	99.21	307.55	20.41	6277.1
	4	431.5	95.88	297.23	19.73	5864.4
	5	418.2	92.94	288.11	19.12	5508.7
	6	406.9	90.41	280.27	18.60	5213.0
	7	397.5	88.34	273.85	18.17	4975.9
	8	390.4	86.75	268.93	17.85	4800.4
	9	385.5	85.66	265.55	17.63	4681.7
Center	10	383.1	85.14	263.93	17.51	4621.4

Weight of one-half of arch..... 55,056.5 lbs.
Weight of whole arch..... 111,913.0 "
Add 10 per cent for joints, etc..... 11,191.3 "
Total weight of arch..... 123,104.3 "

COUNTER-ARCH.

Strain (uniform) Tons.	Area in Sq. Ins.	W'ght pr. ft.—lbs.	Total l'gth. Feet.	W'ght of Counter-Arch—lbs.
72.0 C plus T	24.0	80.0	384.24	30,739.2

Add 10 per cent for joints, etc., ... 3,073.9 lbs.
Total weight of Counter-Arch..... 33,813.1 "

DIAGONALS.

No. piece	Strain in Tons.	Area in Sq. Ins.	W'gt pr ft.—lbs.	Length of Piece.	Weight of Piece,—lbs.
1	21.2 C plus T	8.5	28.3	20.4	577.3
2	32.2 " " "	12.9	43.0	25.8	1109.4
3	37.6 " " "	15.0	50.0	30.1	1505.0
4	40.6 " " "	16.3	54.3	32.4	1759.3

Weight of four diagonals..... 4,051.0 lbs.
Weight of all diagonals..... 19,504.0 "
Add 10 per cent for joints, etc..... 1,980.4 "
Total weight of diagonals..... 21,784.4 "

VERTICALS.

Number of Piece.	Strain in Tons. Compression.	Strain in Tons. Tension.	Area in Sq. Ins.	Weight per foot. lbs.	Length of piece. feet.	Weight of piece. lbs.
End 1	0.0	31.5	7.9	26.3	12.6	331.4
2	0.0	35.2	8.8	29.3	22.4	656.3
3	2.3	39.1	9.8	32.7	29.4	961.4
4	4.4	41.2	10.3	34.3	33.6	1152.5
5	4.9	42.0	10.5	35.0	35.0	1225.0
6	3.6	40.3	10.1	33.7	33.6	1132.3
7	0.8	37.6	9.4	31.3	29.4	920.2
8	0.0	33.6	8.4	28.0	22.4	627.2
Cent'r 9	0.1	31.5	7.9	26.3	12.6	331.4

Weight of one-half of verticals..... 7,337.7 lbs.
Weight of all verticals for live load of 2000 lbs. pr. ft. 14,675.4 "
Weight of all verticals for live load of 2500 lbs pr. ft. 18,344.2 "
Add 10 per cent for joints, etc..... 1,834.4 "
Total weight of verticals..... 20,178.6 "

TIE OR LOWER CHORD.

Strain in Tons.	Area in Sq Inches	Weight per foot.—pounds	Length. feet.	Weight of Tie. pounds.
382.8	76.56	255.2	350.0	89,320.0

Add 10 per cent for joints, etc..... 8,932 lbs.
Total Weight of tie..... 98,252 "

SUSPENDERS.

Strain in Tons.	Area in Sq Inches	Weight per foot.—pounds	Total length—ft	Total Weight. pounds.
42.0	10.5	35.0	469.0	16,415.0

WIND BRACING OF ARCH & COUNTER-ARCH.

160 lbs. per lineal foot=160×350=..... 56,000 lbs.

ROADWAY.

445 lbs. per lineal foot=445×350=..... 155,750 lbs.

SUMMARY.

Arch..... 123,104 3 lbs.
Counter-Arch..... 33,813.1 "
Diagonals..... 21,784.4 "
Verticals..... 20,178.6 "
Tie..... 98,252.0 "
Suspenders..... 16,415.0 "
Wind Bracing..... 56,000.0 "
Roadway..... 155,750.0 "
Total weight of Span..... 525,297.4 "
Weight per foot including ties and rails..... 1,500.0 "

STREET PAVEMENTS.

An Exhaustive Review of the Subject by Mr. Robert Moore before the University Club.

Faults and Excellencies of the Various Systems with Estimates of the Respective Cost of Each.

(CONTINUED.)

(From the St. Louis Republican.)

With us the pavement which first succeeds the broken stone is the

STONE BLOCK PAVEMENT.

Pavements of this class are made of rectangular blocks of stone laid in regular courses and thoroughly rammed; they are pavements in the strict etymological sense. One great advantage of this kind of pavement has been already alluded to. It is that the stones being larger than in the broken stone pavement fewer edges are presented for abrasion, and the wear under the same traffice is consequently much less. And as a general rule the larger the stones the less the wear, or as Mr. Haywood, city engineer of London, puts it: "The cost of repairs is inversely as the size of the stones." They have a still further advantage in that they diminish the traction very greatly over what is on a road of broken stone. The power necessary to draw any load on a good stone pavement is about 1–60 of the total load, whilst on a broken stone it is 1–40 or 50 per cent greater. In other words two horses on a block pavement will draw as much as three horses on a road of broken stone, even when the latter is in good condition. If the blocks are very large however, this advantage is not all realized from the fact that the horses do not get a good foot hold, and do not exert their full power. The Russ pavement, formerly laid on Broadway, New York, in which the blocks had a width of 12 or 14 inches, was so objectionable on this account that it has, I believe, been taken up, although not nearly worn out. The joints between the stones should be frequent enough to give the horse a firm foot hold at every point. For this reason the width of the stones should not exceed the breadth of a horse's foot. For the same reason the joints should be placed at right angles to the line of the street and not diagonally, as is recommended by various authorities.

In addition to the advantages already named, of durability and diminished traction, stone block pavements are cleaner than any we have yet named. As they wear less than broken stone there is less dust formed, and the dust that is formed is more easily removed than from the broken stone, and very much more easily than from the cobble-stones. There is in this a very great sanitary advantage.

The only serious objection to pavements of this class is the noise which they occasion, in which they come next to the cobble-stone pavement, which is, of all, the noisiest. This noise is diminished somewhat by taking care to lay the blocks on the same level and with close joints, but at the best it is very considerable. For some localities, as in the neighborhood of hospitals or churches, or audience rooms of any kind, it is a fatal objection. For business streets, however, this objection is not so serious.

The durability of this pavement, besides being affected, as we have seen, by the size of the stones, is dependent in a still greater degree upon the kind of stone employed, Sandstone, or any kind of soft or friable stone is inadmissable. Limestone, however, of good quality may be employed with very good results. Of this we have numerous instances in St. Louis. Our levees are covered with a rough pavement of this sort, which lasts, I am told, about eight years. The limestone block pavement on Lucas place from Fourteenth to Seventeenth street, was laid in 1856, or nearly 20 year ago, and is still in a condition very far above the average of our streets, although the travel upon it has never been very great. It was never fully up to the standard of what such a pavement ought to be, the blocks being of very unequal widths and many of them very much too large, and ought much of it to be relaid. But with a very moderate expense for this work it is good, I should think, for 20 years more. The pavement on Chestnut street between Second and Third, is a much better specimen of this kind of pavement, and is indeed one of the best pieces of pavement in the city. The stone used in it is from a special ledge much closer and harder than the common run of St. Louis limestone. After three years' service it is in excellent condition, and will doubtless last for 10 or 12 years more.

But good as are the results which may be obtained from good limestone, the best of all stones for this purpose are the harder igneous and metamorphic rocks—such as greenstone, granite, trap and porphyry. In 1824 Mr. Telford was consulted by St. George's parish in London to recommend to them a system of paving. The question being one of great importance. he referred it to the Institution of Civil Engineers of which he was President.

After a full discussion at several sittings they came to the unanimous conclusion that "whin or granite pavement of proper form and depth laid on a sound bottom is preferable to any other," for the carriage ways of a great city.

The experience of the half century that has passed since then has done little or nothing to invalidate this conclusion, so that I am of the opinion that if the same question were put to the same body to-day they would give it the same answer, and a very large majority of American engineers, would, I think, concur with them. In Europe a block pavement of granite or other like stone is to-day the standard pavement for heavy traffic in every large city, and it is very fast becoming such in this country.

For in point of durability nothing has yet been found that is equal to it. How long such a pavement will last in any particular case will depend upon the amount of traffic there is upon it. There are streets in London where the life of granite pavement is not over eight years though the average is about 20 or 25 years. In Paris, where nearly 75 per cent. of carriage ways are covered with this pavement, its average life is about 34 years.

Very much will also depend upon how well the work is done. For a good pavement the width of the stones should be, as I have already intimated, about 4 inches, and the depth and length should be 8 inches. That is each stone should have the form of an 8-inch cube cut in halves. This would give four sides alike of which either could be placed uppermost in case one or more of the others should become too smooth. It would also secure a uniform depth to the pavement which is a matter of the first importance in order to secure a uniform settlement and wear. The foundation should be either concrete, which is best, or gravel not less than 12 inches deep, thoroughly consolidated by rolling or ramming, To this should be added enough clean sand, say 2 or 3 inches, to fill up any inequalities in the stones and give to each a firm bearing. The stones should then be set close together in regular courses with broken joints, and afterwards thoroughly settled by ramming thrice over. The cost of such a pavement in St. Louis would be about $40 per 100 square feet, or nearly ten times as much as a pavement of limestone mcadam, but it would last not less than twenty-five times as long.

Having now considered the various forms of pavement made of stone, we are ready to pass on to the discussion of pavements made of other materials. And for the sake of completeness I will first say a word about

IRON PAVEMENTS.

As I have already said, if it were not for the slipping of the horses, it looks as though the best of materials for paving would be iron. It is smooth, hard, durable and clean. To overcome the objection on account of its slipperiness the cellular iron pavement was invented. Most of you will remember the pavement of this sort that was laid in 1860 on Olive street from Scotland St. to Fourth, as well as on several other streets of heavy travel. About half a mile was laid in all, and strong hopes were entertained that the perfect pavement was at last found.

But these hopes were not fulfilled. The effect of temperature upon it was so marked that in a hot day it would be in ridges. It was so slippery us to be unsafe on the steeper grades, and when any break occurred in it, it was found impossible to thoroughly repair it. Finally, after eight or nine years trial, it was abandoned as a hopeless failure, and the material taken up and sold as old iron. It was replaced by another kind of pavement, of which in turn the highest hopes have been cherished, viz. one of the class of

WOODEN PAVEMENTS.

The first appearance of wood in road building is in the form of corduroy, in which round logs or poles are laid across the road on other logs laid lengthwise, Though frightfully rough, corduroy often serves a good purpose in bridging marshes, that would be otherwise impassable and as a military road it is often very important. The next in order after this is the plank road, in which the logs, before being laid on the road, are sawed into boards This makes a very smooth and excellent road whilst new, and in new countries it is of very great value. In many of our prairie towns it serves as a street pavement. But it is open to several grave objections. The warping of the boards raises them at the ends, and makes the pavement before long very rough.

Then, again, timber laid with the grain of the wood horizontal wears out very rapidly, much more rapidly than in any other position. But even when the travel is not great enough to wear out the planks, the dampness of the ground in a very few years rots them out, so that the wood has to be renewed.

To overcome these objections the plan was devised of cutting the logs into blocks and setting them up on end. This presents the ends of the fibres to the traffic in which position the wear is only one-fourth of what it is when they are horizontal. (See Practical Mech. and Eng. Mag. Oct. 1843, p33.)

Upon this general plan there have been a great many variations. One of the first forms of which I find any description is one used in Russia prior to 1835, and said to be the invention of a Mr. Gourieff. In this plan the blocks were cut into the form of hexagons, the form which allows the blocks to be laid in contact with each other with the least possible loss of timber.

[TO BE CONTINUED.]

The A. G. Pierce Question.

(The accompanying communication of Mr. Dorr's has inadvertently been overlooked for some time, but the question to which it relates is of recent enough occurrence to be familiar to our readers, and Mr. D. wishes to set himself right in the matter, after having more complete particulars, concerning it, to judge from.—ED.)

Having the plat and field notes before us (See ENG. NEWS, March 4th, 1876) we are prepared to discuss the above question intelligently.

Our article of Feb. 5th was abridged somewhat, and this J. B. will please accept as our reply to his criticism in the March 4th number. He will notice that we have never admitted that the 2 acres belonged to sec. 13.

We mistrusted that there was no evidence in the U. S. Deputy Surveyor's field notes or plat, that the section line between 13 and 24 passed over the bluff. This proves to be the case. We did not know but there might be a line blazed over the bluff, or some other evidence.

The Government sold the tract, designated on the plat as containing 47.25 acres, with the understanding that said tract was bounded on the north and west by low water mark on the lake, and the first purchaser bought it with that understanding, and Uncle Sam is not the man to come into court and say, "my agent told me that was so, and I thought it *was* so, but I have found out that I may possibly quibble out of two or three acres, and I am going to try it." If he did try, Chief Justice Waite would tell him he could not have it. It is to be borne in mind that it would be worth only $1.25 per acre to him.

It seems that the N. E. corner of sec. 24 is on the lake shore, and if so, we think there can be no question that the man who owns the 47.25 acre tract is bounded on the north and west by low water mark on the lake shore, and will hold to that boundary in spite of fate.

To find the south boundary of said tract, we should start from, or at a point on the east line of section 24, midway between the E. ¼ post, and the N. E. corner, and run west (parallel with the south line of the section) to the lake.

Answer to A. J Pierce in M'ch 4th number. 1st. Section lines are not generally straight or direct, and there is no reason to suppose that the line between 13 and 24 was a straight or direct line.

2d. The area has nothing to do with the boundary.

We would call the attention of J. E. to the court decision cited in the Feb. 5th number. Also to the fact that Mr. Burdett mentions a larger tract than two or three acres.

We would say to A. R. that in case the office of Co. Surveyor is abolished, it seems very important to us that some provision be made for the preservation of accessible records of all the surveys made in any county.

Our answer to B. K. would be as follows, to-wit: run a straight line from the S. W. corner of sec. 3 to the ¼ post mentioned. and prolong said line till it strikes the north line of said township. At that point establish the corner between secs. 3 and 4.

B. F. D.

ENGINEERING NEWS.

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REPORT OF THE BOSTON PARK COMMISSION.

The Park Commissioners of the city of Boston have recently made a second report. These commissioners are T. Jefferson Coolidge, William Grey, Jr., and Chas. H. Dalton. The considerations which guided them in the selection of the lands, and in recommending them as suitable for parks, etc., are applicable to all cities, and we quote them for the benefit of our readers.

"First—Accessibility for all classes of citizens by walking, driving, riding, or by means of horse or steam cars.

"Second—Economy, or the selection, so far as practicable, of such lands as are not at present income-producing property, and would least disturb the natural growth of the city in its business and domestic life, and of those which would become relatively nearer the centre of population in future years.

"Third—Adaptability, or the selection of lands possessing in the highest degree the natural physical characteristics necessary for park purposes, and requiring the least expenditure for subsequent development.

"Fourth—Sanitary advantages, or the selection of such lands as would probably become unhealthy if neglected or built upon."

They considered carefully the relative density of the population in the different sections of the city, with the idea of having some of the parks readily accessible at all times to those citizens who would be prevented by the nature of their occupations from reaching more distant ground. Where it was possible, land was chosen which, while unsuited for the location of residences, and therefore of moderate value if held for building purposes, would, on account of its irregularity and rocky character, be well adapted for the improvements of the landscape gardener, and by its diversified surface and bold natural features would give pleasure to the eye. In several places fine views of the city and the neighboring country are secured ; an outlook over the harbor, and over a long reach of Charles River is found at other points, and the enclosure of Jamaica pond, seventy acres, in one of the parks will add a very attractive feature.

Where a portion of the city will be likely ultimately to occupy and crowd upon land that is now largely marsh, it is proposed to reserve an open space, for the promotion of the health of the neighborhood, and to improve the spot by a due mingling of land and water, so that it may be well drained and attractive, without too much departure from its present level.

The total number of acres in the proposed new parks and park-ways are 1133, besides some thirty acres for new streets. The estimated cost of land and buildings on the same, exclusive of the streets, is $4,726,400, and of the streets, $235,600, making the required outlay for purchasing the property five millions of dollars. The financial considerations of course come in for their share of discussion. As nearly the whole of the locations are, at the present time, unimproved and non-income producing properties, the transfer of the fee from individual owners to the city will not, in any material degree, affect the aggregate income of the community. The effect of the local improvement in enhancing the value of real estate in the vicinity is pointed out, and the opinion given that the result of the expenditure would be, in a short time, to lower instead of raise the rate of taxation. The fact that the desire to have a pleasant frontage on open land,—such as is obtained with suburban residences in neighboring towns,—carries much capital out of the city is made an argument in favor of the parks. The effect of Central Park, New York, upon the surrounding property is shown from the official records of the Park Commissioners for the first ten years, and the inference is drawn that, allowing one-half of the excess of tax income over interest on the cost of Central Park as due to the natural growth of the city, there still remains nine per cent. on the whole cost, accruing to the public treasury in a single year as a profit upon the investment. The Boston report says that, with the knowledge of such successful financial results in five other cities, it does not now require the same degree of courage as they displayed, to follow in a similar direction.

The professional assistance of Mr. Fred Law Olmsted was sought upon the general scheme ; his previous experience and success have made him an authority. It is not proposed to push forward this project rapidly to completion, but rather to acquire the property, render a portion of it, which is already attractive in natural features, safe and easily accessible as a place of resort, and improve the several parks more gradually, as time and means can be best afforded. There is no doubt that public pleasure grounds add greatly to the desirability of a city as a place of residence, and thus attract people who would otherwise locate outside, and that such breathing places are absolutely necessary from sanitary considerations. The improvement of the public taste is also accomplished, a matter, the value of which is more difficult to reckon up in dollars and cents, but which has a decided influence on the happiness and prosperity of the inhabitants. An enlightened taste, a love of fitting ornament and of the beauties of nature, affect in a marked degree the style of the productions in all branches in arts and manufactures, and enable such productions to command the market. The effect of a park improvement may be very wide-spread, and may appear in very unexpected ways.

Meeting of the Chicago Chapter American Institute of Architects.

The regular meeting of the Chicago Chapter American Institute of Architects was held at the Tremont House Club Rooms, Thursday May 4th, 1876.

Members present, P. B. Wight, Wm. W. Boyington, L. D. Cleveland, S. A. Treat, Samuel Street, J. C. Cochrane and Henry L. Gay.

Minutes of last meeting were read and approved. There being no report from committees the Chapter proceeded to general business.

It was moved by Mr. Cochrane to place the report of the New York Chapter, relative to the Albany state capitol, on file in the records. Seconded and carried.

A vacancy having occurred in the Committee on Admission and the Executive Committee, caused by the withdrawal of Mr. Shipman from the Chapter, on motion it was resolved that the vacancy be filled by an election. On ballot Mr. S. A. Treat was elected to both committees.

Mr. Cochrane presented a communication to the Chapter asking of them an expression for or against the practice of charging contractors for extra sets of plans ordered by them.

Mr. Cochrane stated that he was the architect of the county hospital and employed by the county, that he had made extra sets of plans for two of the contractors for which he had been paid by said contractors. Exceptions had been taken by the Grand Jury to such proceedings. He asked of the Chapter to consider the subject and give its opinion upon such practice.

On motion the communication was referred to a committee comprised of Messrs Cleveland, Bauer and Wight, with instructions that they report to the Chapter. The following communication was placed in their hands:

CHICAGO, May 4th, 1876.

CHICAGO CHAPTER A. I. A.,—

In the report of the late Grand Jury a reference is made to me regarding my charging two hundred dollars to each of the two principal contractors on the new county hospital, and it was made to appear that this was a dishonest transaction. This charge was made by special agreement for a private, separate and extra set of duplicate plans of the two medical pavilions for the contractors' own private use, as Mr. Willard said when he ordered his set "that he might sleep with them and become familiar with them." I desire to submit the case to you to know whether in the opinion of the Chapter it was an honorable transaction. or should there be a limit to the amount of work required of an architect. I had previously made the usual plans and one copy for the work.

This is a question that may be well for the Chapter to decide as it will be a guide in the future to those of our profession. I would say that the price charged was nominal, and for the service. I am not sure that there was one cent of profit to me. Yours &c.,

J. C. COCHRANE, Architect.

Mr. Street presented designs of the Ogle County Jail Ogle Co., Ill., and explained to the Chapter the obstacles met with in the construction of the foundation. Excavation had been made by the county authorities in his absence and the ground had been opened down to a line of quick sand, the soil immediately above being hard clay. Mr. Street explained at length the manner he adopted in avoiding the dangers of the quick sand and stated that he successfully erected the building upon the foundation he prepared. The subject was an interesting one to the Chapter and was listened to with satisfaction by the members present.

On motion the meeting adjourned to Thursday, May 11th, 1876.

The adjourned meeting of the Chicago Chapter A. I. A. was held at the Tremont House Club Rooms, Thursday May 11th, at 3 P. M.

Members present, P. B. Wight, A. Bauer, Wm. W. Boyington, S. A. Treat, L. D. Cleveland, Samuel Street, and Henry L. Gay. Minutes of previous meeting read and approved.

The President explained that this adjourned meeting was called principally to receive the report of the committee appointed to examine the proceedings of Mr. Cochrane with the contractors of the county hospital and that the regular proceeding of opening the meeting would be dispensed with to hear from this special committee.

Mr. Bauer presented to the chair the following report from the special committee, which was read by the chair to the Chapter:

Mr. Cochrane's case is fully stated in the letter referred to us, and he asks our advice in these words: "I desire to submit the case to you to know whether, in the opinion of the Chapter, it was an honorable transaction." He further asks the general question which concerns the practice of every other member, "should there be a limit to the amount of work required of an architect?"

In deciding a case of this nature, the Chapter, composed as it is of fellow architects, and organized under a general constitution and by-laws, must take into consideration the written laws by which we are governed in connection with professional customs which prevail.

In article IV of the constitution of the Institute, section 2 mentions that the condition of membership shall be the honorable practice of the profession in accordance with the constitution, and section 3, immediately following it, says, as if to define explicitly what may be considered dishonorable practice, "no member shall accept direct or indirect compensation for services rendered in the practice of his profession other than the fees received from his client."

In appears in the matter referred to us that the client of Mr. Cochrane was the County Board of Cook County and that Willard and Sexton, both of whom were contractors on the county hospital, cannot be considered as clients to Mr. Cochrane, but solely as contractors. They would therefore come under this rule, which is evidently applicable to Mr. Cochrane's case and we believe that Mr. Cochrane was indiscreet in accepting money from them.

With regard to the professional custom governing the case, all of your committee are of the belief that it is the custom among architects who are most careful in their practice, to furnish all drawings necessary, and frequently extra ones, without further compensation, considering that the receiving of money from a contractor is liable to create suspicion that it is for an ulterior purpose, and desiring to preserve their entire independence as superintendents. Yet it is known to have been the custom among the most honorable architects to charge contractors for all working drawings furnished.

This custom, however, ceased to be prevalent among honorable practitioneers, at least 15 years ago, and it is now considered, as we believe, to be unprofessional, especially since clients have been willing to remunerate architects by percentage.

We find that Mr. Cochrane under his contract with the county, which provided that he should furnish all necessary drawings for carying out the work, did furnish what would have enabled the contractors to complete the the building. The extra drawings furnished both contractors, consisting of duplicate tracings of the general ⅛ scale drawings and covering five sheets each, and were worth the cost of having a draughtsman trace them and the material used, not exceeding $50 a set.

The contractors could have employed any competent draughtsman to trace them from the general drawings furnished them, with the consent of the architect, and we are of the opinion that if such a course had been taken no suspicion could possibly have attached to any one concerned.

Your committee appreciate the fraternal spirit and candor with which Mr. Cochrane has referred to us, to know if he has acted rightly, while resting under a vague imputation of dishonesty which has been published; but we feel that the rule and the practice are clear and pertinent to the case, and regret to be obliged to come to the conclusion that it was indiscreet in him to do work or accept money from contractors working under him.

The entirely open and business-like manner in which it has been done and admitted by all parties, compel us to admit that though the acceptance of money was contrary to the rule, the transaction was not dishonorable in the full sense of the word.

Mr. Cochrane had, as he thought, made all the drawings necessary for the execution of the work and an agreement was made with each contractor to make for them extra drawings for a specified sum before any work was done.

The second question submitted by Mr. Cochrane would require considerable time to examine into and as it involves important points in professional practice we would suggest that its consideration be taken up at a future time.

AUG. BAUER, L. D. CLEVELAND, P. B. WIGHT,
Committee.

On motion it was decided that a stated amount as to the actual cost of such copies of plans as were made, and also, that such plans or copies of plans could be made by the contractors themselves, after receiving the "consent of the architect," be added to the report. With this addition the committee's report was adopted.

After the acceptance of the report, discussion ensued relative to the much vexed question ot the limit of an architect's duties, and the extent and quantity of plans to be produced and furnished upon work in charge.

The President, Mr. Wight, withdrew from the meeting during the discussion, the Vice President, Mr. Bauer assuming the chair. After a half hours' exchange of opinion, on motion, the meeting adjourned.

HENRY L. GAY, Secretary.

The proposed New Water Works at Marshalltown, Iowa.

Marshalltown, Iowa, is about to build water works, and an ordinance has been passed by the City Council authorizing an issue of the bonds of the city to commence the work. The Marshall *Times*, of the 13th instant, says: "The plan now proposed is to construct a substantial engine house at some point on the Iowa River as near to the business part of the city as practicable; to supply the same with the latest and most improved machinery and to lay about five and one-half miles of mains. This will protect nearly every part of the city from fire and give nearly all an opportunity to secure a supply of pure, fresh and wholesome water. A fire alarm telegraph will be constructed from the business part of the city to the engine house, that pressure may be furnished at a moment's notice." The work will be commenced as soon as the necessary contracts can be let.

Annual Meeting of the Boston Society of Civil Engineers.

The annual meeting of the Boston Society of Civil Engineers was held at the society room, Boston, March 15, 1876. President Thomas Doane in the chair and thirty-one members present. The following were elected officers for the ensuing year:

President, Thomas Doane; Vice President, Joseph P. Davis; Secretary, Geo. S. Rice; Treasurer, Clemens Herschel; Librarian, E. K. Clark; Auditor, Henry Manley.

President Doane read the follow report of the Government:

"The total enrolled membership numbers one hundred and twenty-four, twenty-one having been added during the past year. Of this number forty-eight are delinquent either in entrance fee or assessment, while about thirty-seven have been so, for the period of six months, and therefore under the rules of the society, are no longer members. No doubt many of these would gladly pay their dues, were the Treasurer's bills presentcd to them, or presented in such a way or at such a time, that immediate payment could be made. If members desire to remain such they should therefore take pains to keep the Treasurer informed as to their residence and address and promptly respond to the demands made upon them, for these demands are really very small.

From the Treasurer's report you will learn the financial condition of the society. There is quite a sum of money remaining in the treasury, but it is rather the accumulation of entrance fees than receipts from assessments, and as entrance fees are paid but once, we must look well to our sources of income or we shall soon find ourselves in debt. It is deemed best to maintain if possible the present surplus and make assessments which shall cover the current expenses at least.

Four members have deceased during the past year: Thomas Willis Pratt of Boston, an early member of the Boston Society and later a fellow of the American Society of Civil Engineers, died at Boston July 17th, 1875. Joseph Bennett, also an original member of the Boston Society, died at St. Luke's Hospital in New York, of paralysis followed by apoplexy, in private rooms, on the 28th of April. 1875.

James Laurie, also an original member of the Boston Society, and a member of the American Society, died during the last year. Heman Doane Atwood who more recently became a member, and a young man, died at his home in Jersey City on the 19th of Jan., 1876.

The meetings of the society have been interesting and it is believed profitable to those attending. The subjects brought to the attention of the members have been varied, and among them are the following prominent ones:

March 24, 1875, Some Facts and Experiences Concerning Heated Air as a Motive Power.

April 28th, The Comparative Merits of the Pin and Link, and Riveted Iron Bridges.

May 26th, Description of the Union Passenger Station at Worcester, Mass.

June 23d, Description of the Roman Aqueducts.

Sept. 15th, Description of the Paris and London Sewers.

Oct. 20th, Introduction of the Metric System.

Nov. 17th, The Relation of Railroads to the People, and to the State and Nation—What they are and what they should be.

Dec. 15th, River Tower of the St Louis Water Works.

Jan. 17th, 1876, Reports on Matters of Interest in Journals taken by the Society.

Feb. 16th, Description of Willey Brook Bridge and Report on Matters of Interest in the *Jornal of Franklin Inst.*

March 2d, A Discussion of the Boston Sewerage Scheme.

Most of the meetings have been of an informal character, the literary exercises being made up largely of verbal presentations of matter to be laid before the members, followed by questions and answers on the subject. It is to be regretted that so few papers have been laid before the society, or presented in such form that they can be preserved for reference, or exposed to the engineering public for its criticism. It is true that the proceedings might be reported by a short-hand writer, but this method would hardly be as satisfactory, verbal presentations being usually more diffuse and less accurate, and in addition the society is involved in quite an expense for a stenographer.

It is a question which the government of the society recommends to the consideration of the members for its decision, whether to make the meetings altogether informal and conversational, and so run the risk of wasting time and of descending to personal discussions, or whether to confine them mainly to formal papers which shall be read and then opened for discussion simply, with the chance of stiffness and inutility, or whether a middle course shall be adopted, which shall formally bring all matters before the meetings, after which more freedom shall be allowed in the way of questions and answers.

So long as the membership is limited in numbers, unused to the writing of papers, so busy professionally as to be unable to find time for writing, and modest in offering contributions, it will probably be best to follow the middle course. The government would, however, be glad to have an expression of the opinion of the society in the matter for its guidance in the future, in arranging for literary exercises.

An interesting feature in our literary exercises has been the reporting upon the various periodicals taken by the society. One entire meeting has been very profitably devoted to those publications.

It is proposed to make this a regular exercise, giving a few minutes to several of them at each meeting, and thus bringing early to the attention of the members, in as concise a form as possible, all new and interesting matter which might otherwise escape them, either for want of time to read, or because unable to read the languages in which some of them are written.

The Boston Society of Civil Engineers has during the past year taken active measures towards the introduction into the United States of the Metric System of Weights and Measures. Statements setting forth the comparative merits of the present and the proposed systems have been freely circulated among the colleges and scientific schools and societies of the country, most of which have brought acknowledgements of approval.

The society has also formally called the attention of Congress to the matter, and asked that at some time in the future, not too distant, the system be made not only permissive but obligatory throughout the country. It must be a *long war* and the victory must come, not probably by any one battle, but by a series of successful skirmishes, overpowering and turning into allies, one by one, its present enemies. These enemies are first, the *practical* men *simply*, who care for neither this nor that system, but who oppose *only a change*; and secondly, the more *formidable class* which has based all its scientific progress upon the weights and measures now and here in use, and who dread the great labor and cost of making the changes involved in the adoption of the metre as a standard measure.

The Society held its first meeting in these rooms (No. 66 State St.) on December 23d, 1874. It was thought that the society could not prosper unless it had a local habitation and a home where the members could run in to meet each other, and to read. In practice the plan has hardly proved a success. Very few members, aside from the government, have ever visited the rooms, except at the time of the regular notified meetings. The rent of rooms is the largest expense of the Society. It is believed that accommodations for monthly and semi-monthly meetings can be found at much less cost, in connection with some other society or club.

It is also thought that the keeping open rooms cannot be made a success, without the aid of a paid secretary, who shall devote all, or a definite portion of each day exclusively to the interests of the society. If the membership were several times larger than it is, and its individuals willing to pay an initiation fee of $50 with an annual assessment of half this amount, the society might then afford to open conveniently accessible rooms, and so ornament and furnish them with books, papers, etc. as to make them very desirable and pleasant to the members."

Requests were made to the society by the Librarian and Treasurer, and four persons were elected members of the society, after which papers were read by Messrs. Clemens Herschel and Thos. Doane, on "Tidal Drainage" and "Protection of Missouri River Banks" respectively.

(The paper on Tidal Drainage will be published next week.)

Contractors' Intelligence.

The contract for grading the Coldwater & Marshall Railroad from Marshall to Elm Hall, in Montcalm Co., Mich., has been let to a company of which J. Condit Smith is one of the leading men. This road will run through Olivet, Portland, Vermontville and Muir. The people along the line are to furnish the means to grade the road-bed, purchase the ties and build the bridges; the Lake Shore & Michigan Southern Railroad will iron and stock the line when the bed is ready.

It is again announced that the State Board of Control of Swamp Lands, of Michigan, has awarded the contract for building the proposed Marquette and Mackinaw Railroad to what is known as the "Marquette, Sault St. Marie and Mackinaw Railway Company," an association of Upper Peninsula capitalists which was formed two years ago for this purpose. Mr. W. L. Wetmore is president of the company, and Messrs. Peter White, S. P. Ely, Jay C. Morse, Sidney Adams, and James Picands, all of Marquette, are among the principal stockholders. The particulars in regard to this line were given in the number of the NEWS for April 8.

A joint session of the Boards of Selectmen of the towns of New Haven and Orange, Conn., was held on Thursday evening, May 11, 1876. to consider the proposals presented the week before, for constructing an iron bridge over West River, at the Congress avenue crossing. The commiteee to whom the bids had been referred presented a report prepared by the engineers Messrs. C. E. Fowler and A. B Hill, giving in detail, the result of their examination of the plans, strain sheets, etc. All plans presented were found to be substantially up to the standard, with one exception, that of the lowest bidder. No decision was reached that evening, but on Friday evening the contract was awarded to the Watson Manufacturing Co. of Paterson, N. J., on their own plan.—a trapezoidal Pratt truss—for the sum of $6921.25. The contract provides that the bridge shall be erected between Aug. 15th and Sept. 15th. The work of building the abutments and wing walls will be pushed forward as rapidly as possible.

The bids for the construction of a new iron bridge over Cedar River near Vinton, Iowa, were opened on Tuesday the 2d inst., at Vinton, by the Board of Supervisors of Benton County. The following bridge building companys entered proposals for the work:—Wrought Iron Bridge Company, Canton, Ohio—No. 1, $14,700; No. 2, $15,800; No. 3, $13,300; No. 4, $14,400. Penn Bridge and Machine Works, New Brighton, Pa.—No. 1, $25.90 per lineal foot; No. 2, $24 per foot; No. 3, $21.-95 per foot; No. 4, $20 per foot; No. 5, $21 per foot; Nos. 6 and 7, $19 per foot; No. 8, $17.25 per foot. Massillon Iron Bridge Company, Massillon, O.—No. 1, $24 per foot; No. 2, $26.66 per foot. King Bridge Company, Cleveland, O.—No. 1,$12,450; No. 2, $11,-690; No. 3, $12,225; No. 4, $11,450: No. 5, $11,950; No. 6, $11,190; No. 7, $11,725; No. 8, $10,950; No. 9, $7,750; No. 10. $7,250. Cincinnati Bridge Company, Cincinnati, O.—No. 1, $24.95 per foot; No. 2, $22.-95 per foot. McKay & Nelson, Fort Wayne, Ind.—No. 1, $24 20 per foot; No. 2, $26.20 per foot; No. 3, $22 per foot; No. 4, $24 per foot. Clinton Smith Bridge Company, Clinton, Iowa.—No. 1, $13,378.35; No. 2, $13,153.35; No. 3, $10,16870; No. 4, $14,306.47, No. 5, $13,698.98. The contract was awarded at a meeting of the Board on the 11th inst. to the Clinton Smith Bridge Company, for the sum of $14,306.47. The bridge is to be a Wrought Iron Double Intersection Truss, of a total length of 563 feet, consisting of four spans, one of 148 feet, two of 145 feet each, and one of 124 feet. It will be completed in about three months.

PROPOSALS FOR CONTRACTS.

BOILER HOUSE—Proposals for building a boiler house for the Iowa State Agricultural College, at Ames, Ia., in accordance with plans and specifications furnished by said college, will be received by the secretary of the Board of Trustees on or prior to May 25th. The proposals must include all labor and material.

BRIDGE—Proposals will be received at the Auditor's office, in Bryan, Ohio, until 12 o'clock M., June 7th, for the superstruction of a Howe Truss, or Smith Patent Pine Bridge, (high double truss) across the St. Joseph River at West Buffalo, 110 ft. clear span, 120 feet extreme length, 16 feet roadway. Bids for superstructure of bridge to be per lineal foot measuring the lower chord. Said bridge to be set on pile abutments, two rows of five piles each, at each end of the bridge, also, four 16 foot wings four piles to each wing. The timber for pile work to be young, thrifty white oak. Contractors to furnish their own plans and specifications for bridge. Plans and specifications for pile work can be seen at the Auditor's office in Bryan. By order of the Commissioners. J. Kelley, County Auditor.

BRIDGE—Bids will be received by the Commissioners of Douglass Co., Neb., on Saturday, May 27th, at 3 P. M., for building a combination bridge 100 feet long across North Creek, on 16th street, Omaha. Also a 48 foot bridge in section 18 about 4 miles west of Omaha. The plans and specifications may be seen at the Co. Clerk's office. Bids for the first bridge must state price separately for superstructure and substructure in order that plans for the latter may be changed should the board deem it advisable. Lewis S. Reed, Co. Clerk.

BRIDGE—Proposals will be received at the office of the Co. Commissioners, in the city of Wilkes-Barre, Pa., until 2 o'clock P. M., Thursday, June 1st, for building a wooded or iron bridge over northeast or south branch of Tunkhannock Creek, in Scott township, on road leading from Benton to Scranion. near Gardner's school house. Said bridge will be built under the provisions of Act of Asembly, approved April 16, 1870, and subject to the report of the Grand Jury, which determines the amount proper to be expended by the county on said bridge, at the sum of $850, the balance of the cost of superstructure and abutments will be paid by the township of Scott. Plans and specifications for said bridge may be seen at the Commissioners' office, when the letting will take place, or bidders may accompany their bids with plans and specifications of such bridges as they know to be durable and economical; Proposals must be sealed and indorsed "Proposals for building a bridge over the northeast branch of Tunkhannock Creek." N. N. Dean, Samuel Line, Peter Jennings.

COURT HOUSE—Bids will be received at the office of the clerk of the Board of County Commissioners of Storey Co. Nev. until May 28th, at 11 A. M. for the building of a court house in Virginia City, Nev., in accordance with plans and specifications now open for inspection at the office of the Fulton Foundry. Each bid must be accompanied by a certified check for $5-000, as a guarantee of the good faith of the bidder; and must also be accompanied by the names of bondsmen, who will become sureties to the amount of 25 per cent of contract price for the faithful performance of the work. The entire work to be completed in 120 days from date of contract. By order of the board. W. G. Thompson, Clerk.

DREDGING—Bids will be received at the office of the Harbor Board, Baltimore, until noon, May 30, and opened immediately thereafter, for the excavation and removal of material from the inner harbor or basin of Baltimore. The right is reserved by the board to reject any or all proposals, and none will be entertained for less than 50,000 cubic yards, or more than 200,000 cubic yards. Specifications and any other information can be had by application to the office of the Harbor Board, City Hall, Baltimore, on and after May 16; By order of the Board. N. H. Button, Engineer.

DREDGING—Bids will be received at the City Engineer's office, Providence, R. I., until Saturday, June 10th, at 12 M., for removing 250,000 cubic yards (more or less) of earth from the Cove Basin. Bidders will state price per cubic yard for excavating and removing, the earth to be at the disposal of the contractor. Further information may be obtained by addressing Chas. E. Paine, City Engineer, No. 17 FourthMain street. Proposals properly endorsed should be addressed to Henry C, Clark, Chairman of Committee.

EMBANKMENT—Proposals will be received until Saturday May 27th, at 12 o'clock for the construction of an embankment of about 7,000 cubic yards, and for rip-rap paving the upper face thereof, on the premises of the undersigned, along the bank of Whitewater River, one mile north-west of Harrison, O. Specifications may be seen and proposals left at the office of the undersigned, in Harrison, or in care of Sam. P. Bowles, County Commissioners' office, Cincinnati, to whom apply for further information. Dair & Breckenridge.

HEATING APPARATUS—Bids will be received until 12 M. June 15th, for heating the buildings of the Institution for the Deaf and Dumb, at Council Bluffs, Ia. Bidders will furnish their own specifications; but printed directions will be furnished them on application to Wm. Ward, Supt., Council Bluffs, Iowa. By order of the Board of Trustees. Thos. Officer, President.

HOSPITAL BUILDING—Proposals will be received at the Dayton Hospital for the Insane, at Dayton, O., until 12 M. June 7th for taking down a part of the old laundry building, and for performing all the labor and providing all the materials necessary to the erection and completion of an addition to the laundry building at said hospital: and a contract based on said sealed proposals will be made. No proposal will be considered by the trustees of said hospital unless accompanied with a bond of the proposers, with sufficient security in the sum of $2,000, conditional according to law. See acts of 1873, page 103, section 4. Plans and specifications for said building can be seen at the office of said hospital; also, at the office of the Auditor of State, at Columbus, Ohio, at all business hours from this date until the awarding of the contract. A. G. McBurney, W. J. Conklin, W. H. Manning, O. M. Godfrey, Trustees of Dayton Hospital for Insane.

HEATING APPARATUS.—Proposals for furnishing all material and putting the heating apparatus in the new library building in Detroit, Mich., will be received at the office of the chairman of the committee on public library, until May 22d, at 12 o'clock M. Bidders will be required to furnish plans and specifications in detail; also to file with their bids a bond with two responsible sureties in the sum of $2,000, conditioned that they will within ten days after notification of the acceptance of their bid enter into contract for the faithful performance of the work. Bonds with sufficient sureties in double the amount of the contract will be required from the successful bidder for the faithful performance of the work and the successful operation of the same for the term of one year. The committee expressly reserve the right to reject any or all proposals. Information as to the work required can be had of George Morhouse, Superintendent. John T. Leggett, Henry F. Lyster, Joseph Nicholson, D. J. Workum, James J. Martin, Committee on Public Library.

ROOF AND CORNICE WORK—Proposals, addressed to the undersigned, will be received at the office of the Washington Aqueduct in Washington,, D. C. until 12 M., June 12, for constructing an iron truss roof and galvanized iron cornice on the Gate House at Great Falls. Plans and specifications can be seen at this office, and all necessary information can be obtained from O. E. Babcock, Col. of Engnrs., U. S. A., Chief Engr. Washington Aqueduct.

SCHOOL HOUSE.—Bids will be received at the Township Clerk's office, Youngstown, Ohio, until 12 M, May 27th, for a school house at Brier Hill, known as sub-district No. 3, in the township of Youngstown. Separate bids will be received for the masonry, carpenter work, plastering and painting, or bids will be received for the whole job; but such bids must be made for the several portions in detail; plans and specifications may be seen by applying to Andrew Shaffer, Township Clerk, at his office. Building Committee.

SCHOOL HOUSE—Proposals will be received at the office of the Clerk of Bethel Township, Clark Co., Ohio, until 12 M. June 10th, for building a school house in sub-district No. 10. of said township, according to plans and specifications on file in said office. The bid for each kind of material called for by the specifications must be stated separately, one the price of labor must also be stated separately. By order of the Board of Education. H. N. Taylor, Township Clerk, New Carlisle, Ohio.

SCHOOL HOUSE—Proposals will be received at the Clerk's office, Williamsport Station, Deercreek township, Pickaway County, Ohio, until 12 M. May 24th, for the brick, lumber, masonry, carpenter work, plastering, glazing and painting, of a school house, to be erected in sub-district No. 4 in said township. Plans and specifications can be seen at the clerk's office. By order of the Board of Education. Cyrus Hornbeck, President. J. D. Finnell, Clerk.

SCHOOL HOUSE.—Bids will be received at the Township Clerk's office of Coventry township, Summit Co., O. until 12 o'clock, M., May 27th for building a school house on the lot situated in sub-district No. 4 of said township, according to plans and specifications on file with the Township Clerk. The bids for each kind of material called for in the specification must be separately stated. By order of the Township School Board. A. Oberlin, Jr., Clerk.

SCHOOL HOUSE.—Bids will be received at the office of the Clerk of the Board of Education of Springfield township, Summit Co., O., until 12 o'clock M., on Tuesday, May 30th, for building a school house on the lot situated in sub-joint district No. 7 in said township according to plans and specifications on file in said office. The bid for each kind of material called for by the specifications, must be separately stated, and the price of each stated, and the price of labor must also be stated separately. By order of the Board of Education. Thos. J. Gilcrest, Clerk.

SCHOOL HOUSE—Proposals will be received by the School Board of the Independent school district of Pella, Ia., until noon June 17th, for the erection of a school house, plans and specifications of which can be seen at the office of C. Rhynsburger, Pella, Iowa. Bids may be made as follows: 1, excavation, draining and grading; 2, stone and brick work of entire foundation; 3, all brick and stone work above foundation; 5, carpenter work on entire building; 5, painting and glazing, also all tin or iron work in and about building including gutters; 6. entire building, covering all above named separate items. Address D. S. Huber or C. Rhynsburger, Pella, Iowa.

STATE REFORM SCHOOL.—The trustees of the Iowa Reform School hereby give notice that they intend to erect a main building for said school, and will receive bids for three hundred thousand or more brick of best quality, delivered in Eldora. Two hundred or more legal perch of best quality foundation stone, delivered at Eldora or at quarry, also the price per m. of the various kinds of lumber necessary for such building, all to be delivered as above. All bids will be addressed to E. Andrew, Eldora, Iowa, and will be received until May 31st, at which time they will be opened and examined. J. A. Parvin, president. T. E. Corkhill, secretary.

SCHOOL HOUSE.—Bids for the erection of a school house for the Independent district of Logan, Harrison Co., Iowa, accompanied by plans and specifications of the same will be received and contract let at the school house in said district, May 27th, at 1 P. M. No plans and specifications will be received which are not accompanied with a bid to erect the same. Said school house is to be built of brick, with stone foundation, to be two stories high, and to be heated by furnace, and to be sufficient in size to seat at least two hundred pupils, the cost of said building not to exceed $5,000. W. H. Davis, G. B. Cadwell, D. S. P. Michael, Directors.

SCHOOL HOUSE—Proposals will be received until 12 o'clock M. Tuesday, May 23d, for the excavation, brick and brick work, stone and stone work, iron and iron work, tin and tin work slate and slate work, plastering and plastering work, paint and painting, glass and glazing, lumber and carpentry, for eight roomed school building to be built in the town of Dresden, Ohio according to plans and specifications, as designed by J. T. Harris & Co., architects, Columbus, Ohio. Bids will be received for the whole or any part of the above, but all bids must give the itemized price for the work and for the materials in each branch according to the school law of the state. The architects will be in Dresden the day before and the day of letting, to give any explanations that may be desired. J. W. Alloways, O. F. Edwards B. F. Cemert, L. F. Estinhausen, Peter Schaumleffle, E. Jones, Building Committee.

STATE ROAD—Notice is hereby given that $2,000, to be paid in State Swamp Lands, has been appropriated by the Board of Control to be expended on the west division of the Alpena and Torch Lake State Road, commencing at the Seven Mile Post on section 33. town 31 north, range 8 west, in the township of Central Lake, Antrim County, Mich., and continuing west to said state road survey. The job for constructing said road will be let to the lowest responsible bidder or bidders, on Tuesday, June 6th at P. M. at Wadsworth's store in said township where sealed proposals for doing said work will be received by the undersigned until 10 o'clock A. M. of said day. Payments for said work will be made in State Swamp Lands, according to law. Contract blanks showing how the road must be built, and a diagram and field notes of the survey, can be seen at the residence of the undersigned. James M. Wadsworth, Local Commissioner, Central Lake, Mich.

SCHOOL HOUSE—The Board of Education of Jefferson township, Franklin county, Ohio, hereby invite bids in accordance with section 54, Ohio School Laws, for the building of two school houses in said township, on the sites now occupied for school purposes in sub-districts Nos. 4 and 8. Specifications: Size, 24x32 feet; walls brick, good quality, 13 inches thick, 12 ft. story above foundation; foundation to be of good stone and extend not less than 2½ feet above the surface of the ground, and to be not less than 20 inches thick, with center wall 12 inches thick, well laid in mortar. Each house to have two doors (state price of one) with transom light above, and 3 well proportioned windows on each side of the house in box frames, with pulleys; the finish to be plastering and wainscoting. The wainscoting to be put on after one coat of plastering from the floor to the base of the windows. The walls to have three coats, the last one hard finish. With seats of an approved make and pattern; first-class pine shingles to be used in roofing, with 15 inch cornice; all lumber to be first-class. The old houses are of brick; size of one in sub-district 4, 20x26 feet; in sub-district 8, 20x24 feet, with 8 inch wall, and 9 feet story, on stone foundation. The material in these must be taken into account, and used as far as practicable in the construction of the new houses. Bids will be received at the office of the Township Clerk until June 3d at which time they will be opened. Any other information may be had by applying to E. Dryer, Gahanna, or H. J. Rhodes and J. W. Sagar, Black Lick, committee.

WATER WORKS.—City Council of Peoria, Ill, invite bids, accompanied with plans and specifications, for building a filter bed at the water works. Bidders will state the plan of filtration proposed, the size and shape of bed, and nature of materials they propose to use. Bids to be left with the city clerk on or before May 24, 1876. Chas. H. Kellogg, Thos. J. Kelly, John P. Cress, Water Works Committee.

WATER WORKS RESERVOIR—Proposals will be received at this office, 61 State Street, by the Water Commissioners of the city of Albany, N. Y., until May 25th, at noon, for the construction of the above named work. The reservoir is to hold about 6,000,000 gallons. Top of embankment to be about 21 feet above bottom of reservoir. Plans and specifications may be seen at the office of the engineer, 59 State Street. Contractors will be required to give security to the amount of $25,000. Each proposal should be endorsed thereon "Proposal for Prospect Hill Reservoir." I. C. Chesbrough, Engineer.

STATE PENITENTIARY.—The undersigned commissioners under an act of the State of Texas, approved February 16 hereby advertise for proposals of plans, specifications and other particulars for the proper and substantial building and completion of two penitentiaries in said state in conformity to the modern forms of constructing public prisons, which have proven to be the best for the health and comfort of the convicts. One of said penitentiaries to be built about two miles north of Rusk, in Cherokee county, with a view of utilizing in manufactures the iron ores which abound in this section of the state; the other to be built at the head of the San Marcos River, in Hayee county, contemplation of the manufacture of cotton, wool, leather and other goods and fabrics, that will not come into competition with the personal industries of the mechanical professions. Said penitentiaries are to be completed by the first day of July 1877, and parties making proposals of plans, etc., for both, or either of said penitentiaries, will state upon what terms and for what amounts they will build the same, and will, in connection with said proposals, furnish due guarantees of their abilities to build and complete the same in accordance with such plans, etc., and by the time limited. Persons desiring to inspect the sites indicated will call on E. L. Gregg, at Rusk, or Gen. Ed. Burleson at San Marcos, and all proposals will be addressed to E. L. Gregg, at Rusk, Cherokee county, Texas. The commissioners expressly reserve the right to reject any and all proposals, and hereby give notice that no compensation will be made for any proposals, plans, etc., which may be submitted under this advertisement. W. W. Lang, Ed. Burleson, B. W. Brown, E. L. Gregg, Commissioners.

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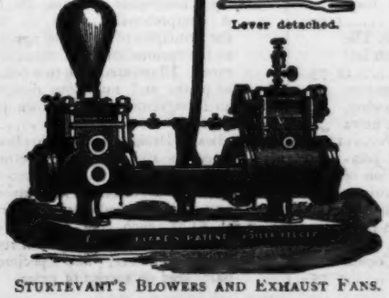

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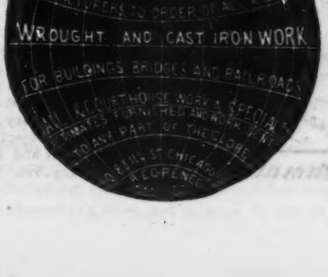

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